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Hydrothermal growth and piezoelectric response of Li,Ta-doped (K,Na)NbO_3 nanorod arrays

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Research and development on the Lead-free piezoelectric nanomaterials have attracted great attentions owing to their great potential for the application in energy harvesting and micro/nano-scaled sensors and actuators. Among the lead-free piezoelectric materials, potassium sodium niobite ((K,Na)NbO_3, KNN) have been regarded as the one of the most promising systems due to their high piezoelectric coefficient and energy conversion efficiency. However, piezoelectric performances of pure KNN are not able to be comparable with that of traditional piezoelectric material Pb(Zr,Ti)O_3. Most of the research works are focusing on modifying KNN-based ceramics and improving piezoelectric responses by doping Li(Lithium) and Ta(Tantalum) into the lattice, which can decrease their phase transition temperature TO-T to room temperature. In this work, the Ta-doped KNN nanorods were synthesized through substrate-oriented hydrothermal process. the response of the KNN NRs along radial direction was also studied by PFM method. Until now, typical butterfly-shape curves and reverse-phase curves of synthesized nanorods were attained by PFM examination. In addition, the enlarged lattice spacings because of substitution of Ta were observed according to TEM results, and the EDS results obviously show the existence of Ta. However, these results need farther and more systematic analyses, and this research is under way. In near future, Li,Ta-doped (K,Na)NbO_3 nanorods will be tried to synthesized by hydrothermal method. Moreover, the growth behavior and revolution on the composition, phase and piezoelectric performance with the change of hydrothermal reaction conditions will be systematically studied.